REMARKS/ARGUMENTS

Claims 1-8 and 13-15 have been canceled, without prejudice or disclaimer, since claims 1-8 and 13-15 were withdrawn from consideration, but Applicant reserves the right to file a divisional application containing claims 1-8 and a divisional application containing claims 13-15.

Claims 9, 16, and 17 were rejected under 35 U.S.C. §103(a) as being unpatentable over Stark et al., WO 01/16493 A1, in view of Frenzl, U.S. Patent No. 3,823,872, further in view of Smith, U.S. Patent No. 5,697,361, and further in view of Zindl et al., U.S. Patent No. 6,899,198 B2 in the Office Action. Reconsideration of the rejection is respectfully requested.

Claim 10 was rejected under 35 U.S.C. §103(a) as being unpatentable over Stark et al. in view of Frenzl, further in view of Smith, and further in view of Zindl et al. in the Office Action. Reconsideration of the rejection is respectfully requested.

Claim 11 was rejected under 35 U.S.C. §103(a) as being unpatentable over Stark et al. in view of Frenzl, further in view of Smith, and further in view of Zindl et al. in the Office Action. Reconsideration of the rejection is respectfully requested.

Claim 12 was rejected under 35 U.S.C. §103(a) as being unpatentable over Stark et al. in view of Frenzl, further in view of Smith, and further in view of Zindl et al. in the Office Action. Reconsideration of the rejection is respectfully requested.

Independent claim 9 has been amended to provide, in part, for, "the continuous geometry of the double-cone device being configured to reduce the noise generated by a flow profile of the fluid flowing through the double-cone device." Antecedent basis for the amendment to independent claim 9 is found in the specification, for example, on page 10, line 27, to page 11, line 6. Since claim 17, directly dependent on claim 9, is substantially redundant to amended claim 9, claim 17 has been canceled, without prejudice or disclaimer.

In connection with the rejection of independent claim 9 in the Office Action, the Examiner admits that, "[a] combination of Stark and Frenzl ... fails to teach noise reduction," (page 4, lines 16-17). The Examiner contends that Smith discloses noise reduction since, "Smith teaches the limitations for a jet venturi pump in which a porous diverging section 125 is used to reduce the level of noise generated when external air is induced to flow into ports 117 by high pressure air flow exiting region 116 (Smith - col. 5 ll. 31-50)," (page 4, lines 18-21; emphasis supplied).

Smith states that the "external noise of the jet venturi induction pump may be reduced and the number of particles in the induced air may be reduced using the mufflers of embodiment two and three jet venturi induction pumps," (column 6, lines 46-50; emphasis supplied). Thus, Smith expressly teaches that the mufflers disclosed therein are reducing the external noise of the jet venturi induction pump. In contrast, claim 9 has been amended to provide for the reduction of noise generated by a flow profile of the fluid flowing through the double-cone device by the continuous geometry of the double-cone device. Smith does not appear to disclose, teach, or suggest either the reduction of noise generated by a flow profile of fluid flowing through a double-cone device or continuous geometry of a double-cone device reducing the noise, as claimed in independent claim 9.

In addition, the Examiner indicates, in connection with the rejection of independent claim 9, that, "Zindle teaches the limitations for varying the size of pores or interstitial spaces in a muffler material generally used to reduce sound generated by a jet pump 2 (Zindle et al. - col. 3 ll. 39-47). Further Zindle teaches that it was known in the art to vary size of said pores and space on the order of a nano range of sizes," (Office Action, page 5, lines 18-22).

However, Zindl et al. teaches that, "[f]ine pores and pores in the nano range of size or interstitial spaces in such material [referring to the muffler body 18 of porous muffler material] render possible the passage of compressed air given a sufficiently high pressure gradient," (column 3, lines 44-47; emphasis supplied). Thus, Zindl et al. only refers to pores in the nano range of size to render possible the passage of compressed air under high enough pressure. Zindl et al. does not appear to teach, disclose, or suggest the range of sizes of the holes in the second porous diverging section in a range of 50-500 μm "to provide relatively silent suction of the fluid without reducing the suction capacity," as provided in independent claim 9.

The Examiner further contended in the Advisory Action that Zindl et al. teaches two parameters of pressurized fluid flow which are affected by the size of pores in the muffler, the first parameter being noise reduction and the second parameter being passage of fluid under a certain pressure gradient, (page 2, paragraph b.i., lines 3-4, 14).

With regard to the parameter of noise reduction, the Examiner argued that, "if the pores [sic] sizes in the material of which the muffler is exclusively composed are varied in order to permit passage of air under a certain pressure gradient, the variation is done with the inherent

purpose of the muffler maintaining or enhancing its ability to perform its intended function of reducing noise," (page 2, paragraph b.i., lines 11-13). However, there is no teaching in Zindl et al. to vary the size of the pores to achieve or maintain noise reduction. Zindl et al. simply teaches that the pores are fine or in the nano range of size to render possible the passage of compressed air given a sufficiently high pressure gradient.

As far as enhancing or maintaining the muffler's function of reducing noise is concerned, Zindl et al. teaches features of the muffler that are intended to accomplish this other than the size of the pores. In particular, in comparing the compressed air muffler disclosed in Zindl with the prior art compressed muffler, the body of which was seated in a sleeve-like housing covering the outer periphery of the muffler body, (column 1, lines 18-21, 33-35), Zindl et al. states that, "the compressed air can now flow out through the bare outer periphery of the muffler body so that the volumetric flow emerging at the front outlet opening and the noise caused by the free jet are reduced. The stepless shape of the duct has the advantage in this respect that the formation of eddies is prevented, which might prevent or interfere with the passage of the compressed air through the wall of the muffler body," (column 1, lines 55-62; see also column 3, line 61, to column 4, line 7; column 4, lines 16-26). Furthermore, Zindl et al. teaches that the muffler body should possess an externally tapering configuration matching that of the outlet duct so that it preferably has a constant wall thickness along its length to reduce the noise of the flow emerging at the front outlet opening of the muffler still further, (column 2, lines 28-38; column 4, lines 8-14).

Thus, Zindl et al. appears to teach three characteristics of the compressed air muffler for reducing noise. The first characteristic is that the outer periphery of the muffler body be uncovered. The second characteristic is that the outlet duct extending through the muffler body steplessly merges with a duct section extending in an attachment section, (column 4, lines 16-22). The third characteristic is that the muffler body possess an externally tapering configuration matching that of the outlet duct so that the muffler body preferably has a constant wall thickness along its length. Nowhere is it taught, disclosed, or suggested to vary the range of sizes of the pores in order to further reduce the noise or to maintain noise reduction. The range of sizes of the pores are merely to render possible the passage of compressed air given a sufficiently high

pressure gradient, not to increase or maintain the passage of compressed air through the muffler body so as to further reduce the noise or to maintain noise reduction.

Furthermore, with respect to the second parameter, alleged by the Examiner to be affected by the size of pores in the muffler, namely, the passage of fluid under a certain pressure gradient, it must be noted that Zindl et al. teaches the expulsion of compressed air from the muffler body 18 through the wall 25 of the muffler body and emerging at an outlet flow face 24, the flow of the compressed air being indicated by arrows 26, (column 3, lines 61-67; see Figs. 1 and 2). In contrast, independent claim 9 provides that the second porous diverging section extending from the neck is configured to achieve suction, and that the range of hole sizes is configured to provide relatively silent suction of the fluid without reducing the suction capacity. Thus, in independent claim 9, fluid is being sucked through the holes, whereas in Zindl et al., compressed air is being expelled through the pores. There is, thus, a clear difference between the range of hole sizes in claim 9 and the hole sizes disclosed in Zindl et al. The hole size range in independent claim 9 is configured to avoid the reduction of suction capacity and to provide relatively silent suction of the fluid. The hole sizes disclosed in Zindl et al. are disclosed to render possible expulsion of compressed air from the muffler given a sufficiently high pressure gradient.

Moreover, as the Examiner admits, Zindl et al. does not teach the claimed range of 50-500 μm for the holes in the porous diverging section, (see Office Action, page 7, lines 6-8). The Examiner, however, contends that such a range is merely an optimum or workable range and, therefore, can be discovered using only routine skill in the art, (see Office Action, page 7, lines 9-15).

The Examiner's conclusion that the range of 50-500 μm for the hole size in the porous section is merely an optimum or workable range discoverable by using only routine skill in the art appears to ignore the requirement of the Manual of Examining Procedure (MPEP) providing that, "[a] particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation," (MPEP §2144.05, page 2100-152, left column, clause B, lines 1-5). Thus, the hole sizes of the porous diverging section claimed in independent claim 9 must be recognized to achieve the result of providing relatively silent suction of the fluid without reducing the suction capacity in order for

the determination of the range of hole sizes claimed in claim 9 to be characterized as routine experimentation.

However, the Examiner, in the Advisory Action, relies upon the inherent function of Zindl et al. as a muffler to conclude that Zindl et al. "inherently teaches that a change in pore size affects the performance of a muffler to reduce sound because the muffler is made exclusively of materials of which the only aspect of their design which is changed is the size of the pores within," (page 2, paragraph c.i., lines 3-5).

First, as demonstrated above, Zindl et al. teaches three characteristics of the muffler to maintain or enhance noise reduction, <u>other than the size of the pores</u>. Second, even if it is conceded for the sake of argument that Zindl et al. teaches the variation of pore size to maintain or reduce the reduction of noise in the muffler, which is denied as argued above, the Examiner is only addressing half of the argument of the Applicant since the Examiner is only dealing with the result of effecting noise reduction.

However, the pore size range claimed in independent claim 9 has a <u>dual</u> result, not only to provide relatively <u>silent</u> suction of the fluid, but <u>also</u> to provide such suction <u>without reducing the suction capacity</u>. The Examiner has not shown that Zindl et al. teaches that the hole sizes disclosed therein achieve this dual result of one, providing relatively silent suction of the fluid and two, avoiding reducing the suction capacity. Indeed, as demonstrated above, Zindl et al. itself teaches <u>away</u> from any result of preventing the reduction of <u>suction</u> capacity since Zindl et al. is <u>not concerned with suction at all</u>. Rather, the muffler disclosed in Zindl et al. achieves its muffling function by <u>expelling</u> compressed air, <u>not sucking in that compressed air</u>. In contrast, claim 9 provides for achieving <u>suction</u>, and claims a range of hole sizes to <u>avoid reducing the suction capacity</u>. Thus, it is respectfully submitted that Zindl et al. does not teach a range of hole sizes which achieve a result of providing relatively silent suction of a fluid without reducing the suction capacity as claimed in claim 9. Indeed, Zindl et al. teaches that the disclosed pores allow <u>the expulsion of compressed air</u>, <u>rather than the suction of such compressed air</u>, as would be required by independent claim 9.

Since each of claims 10-12 and 16 is directly dependent upon independent claim 9, each of claims 10-12 and 16 is allowable for at least the same reasons recited above with respect to the allowability of independent claim 9.

New independent claim 18 is based upon independent claim 9, but excluding the amendment to claim 9 quoted in the sixth paragraph of page 7 of this Amendment. However, new independent claim 18 further provides that the 500 μm upper bound of hole size is configured to prevent interference with the continuous geometry of the double-cone device so as to provide relatively silent suction of the fluid, that the 50 μm lower bound of hole size is configured to prevent reduction of the suction capacity, and that the continuous geometry of the double-cone device is configured to reduce noise levels during operation of the double-cone device. Antecedent basis for these features of independent claim 18 is found in the specification, for example, on page 10, line 27, to page 11, line 12.

In addition, it can be deduced that the upper bound of hole size of 500 μm in the second porous diverging section is configured to prevent interference with the continuous geometry of the double-cone device. This is because if such upper bound was exceeded and such holes were in the wall of the double-cone device, such holes would interfere with the continuous geometry of the double-cone device, claim 18 providing that the continuous geometry of the double-cone device is configured to reduce noise levels during operation of the double-cone device. Thus, large holes, by interfering with the continuous geometry of the double-cone device, would increase noise levels. The increase of noise levels should occur, at least in part, by preventing relatively silent suction of the fluid in order to negate the claimed result of the hole size range of providing a relatively silent suction of the fluid. Furthermore, it can easily be seen that as the hole size decreases in the second porous diverging section, the suction capacity of each hole decreases. Therefore, it should be apparent that the lower bound of hole size of 50 μm is configured to prevent the reduction of the suction capacity, which is the other one of the claimed results of the range of 50 to 500 μm for the hole sizes.

Although Zindl et al. discloses a range of hole sizes in the nano range of size for rendering possible the passage of compressed air given a sufficiently high pressure gradient through a muffler body, (column 3, lines 39-48), there is no disclosure, teaching, or suggestion in Zindl et al. that a 500 μm upper bound of hole size prevents interference with the continuous geometry of a double-cone device or that the 50 μm lower bound of hole size prevents reduction of the suction capacity. Indeed, as previously demonstrated, Zindl et al. is concerned with hole

sizes to allow the <u>expulsion</u> of compressed air from a muffler body, <u>not the suction</u> of such air into a muffler body, as would be required by independent claim 18.

New dependent claims 19-21, which are directly dependent upon new independent claim 18, have been added. New dependent claims 19-21 are based on claims 10-12, respectively, except in the following particulars. New dependent claim 19 changes the upper bound of 10° of the conical angle of the first tapering section in claim 10 to 5° and adds the feature that the range of the value of the conical angle is configured to allow the device to achieve reduced noise levels and lower energy input. Antecedent basis for these features of claim 19 is found in the specification, for example, on page 8, lines 5-6 and 12-14. New dependent claim 20 changes the upper bound of 10° of the conical angle of the third diverging section in claim 11 to 4° and adds the feature that the range of the value of the conical angle is configured to allow the device to achieve reduced noise levels and lower energy input. Antecedent basis for these features of claim 20 is found in the specification, for example, on page 8, lines 5-7 and 12-14. New dependent claim 21 differs from dependent claim 12 in that the range specified for the size of the diameter of the larger diameter end of the second porous diverging section is configured to produce an acceptable level of suction force. Antecedent basis for this feature of dependent claim 21 is found in the specification, for example, on page 9, lines 19-26, and on page 10, lines 19-23.

With regard to claim 10, the Examiner admits that the combination of references over which claim 10 is rejected "does not explicitly teach a conical angle that is less than or equal to 10°," (Office Action, page 8, paragraph 7, line 6). However, the Examiner contends that, "[i]t would have been obvious to one having ordinary skill in the art at the time the invention was made to form a first tapering section with a conical angle that is greater than 0° but less than or equal to 10°, since the claimed values are merely an optimum or workable range. It has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art," (Office Action, page 8, paragraph 7, line 6, to page 9, line 5). Similarly, with regard to claim 11, the Examiner admits that the combination of references over which claim 11 is rejected does not expressly teach a conical angle that is less than or equal to 10°, but that the range of conical angles claimed of greater than 0° but less than or equal to 10° is merely an optimum or workable range, the

discovery of which involves only routine skill in the art, (Office Action, page 9, paragraph 8, lines 3-12).

With regard to claim 12, the Examiner admits that the combination of references over which claim 12 is rejected "does not explicitly teach that an end of a second section has a diameter that is less than one and a half times larger then [sic] than the smaller diameter end of a first tapering section," (Office Action, page 10, lines 2-4). However, the Examiner contends that, "[i]t would have been obvious to one having ordinary skill in the art at the time the invention was made to form a larger diameter second end of a porous diverging section of a double cone nozzle to be less than one and a half times larger then [sic] a small diameter end of a first tapering section that transitions into the first end of the porous diverging section, since the claimed values are merely an optimum or workable range. It has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art," (Office Action, page 10, lines 4-11).

However, as previously stated, the MPEP requires that a particular parameter be recognized as a result-effective variable or, in other words, a variable that achieves a recognized result before the determination of the optimum or workable range of the variable might be characterized as routine experimentation. Thus, the Examiner's conclusion that the angular ranges claimed in claims 10 and 11 are optimum or workable ranges, and that the range of the larger diameter of the second porous diverging section claimed in claim 12 is also an optimum or workable range assumes that those angular ranges or the range of the larger diameter of the second porous diverging section are recognized as a result-effective variables before the determination of the optimum or workable ranges of those variables might be characterized as routine experimentation. Thus, for dependent claims 19 and 20, the references or some combination thereof must be shown to recognize that the angular ranges in claims 19 and 20 allow a double-cone device to achieve reduced noise levels and lower energy input. Analogously, with regard to dependent claim 21, the references or some combination thereof must be shown to recognize that the claimed range of size of the larger diameter of the second porous diverging section of a double-cone device produces an acceptable level of suction force.

It is respectfully submitted that the references applied in support of the rejections of claims 10-12 do not appear to teach, disclose, or suggest that the angular ranges of claims 19 and

20 are configured to allow a double-cone device to achieve reduced noise levels and lower energy input or that the range of size of the larger diameter of the second porous diverging section of a double-cone device, as claimed in claim 21, is configured to produce an acceptable level of suction force.

New independent claim 22 is based upon independent claim 9, excluding the amendment quoted in the sixth paragraph of page 7 of this Amendment, combined with the features of dependent claim 16. Thus, new independent claim 22 is the result of rewriting dependent claim 16 in independent form, but incorporating provisions of independent claim 9, from which dependent claim 16 directly depends, based upon the features of independent claim 9, but not including the amendment to claim 9 quoted in the sixth paragraph of page 7 of this Amendment.

With regard to the rejection of dependent claim 16 in the Office Action, the Examiner alleges that, "Stark teaches that an improvement of the double-cone device 21 is that wear on the walls of the device is reduce [sic], however this is due to less turbulent flow (Stark - col. 2 ll. 28-20). Stark states that wall material is better able to resist wear resulting from fluid flow, therefore wall is still subject to fluid contact, the difference being that contact is less detrimental to the lifespan of the double-cone device 21 (Stark - col. 2 ll. 37-40)," (Office Action, page 7, line 22, to page 8, line 5).

The Examiner, apparently in attempting to meet the provisions of claim 16 that the continuous geometry of the device is configured to cause the flow profiles of the fluid to remain in contact with the wall of the neck, with the wall of the second porous diverging section, and with the wall of the third diverging section, alleges that Stark et al. teaches that the wall is subject to fluid contact. However, claim 16 is dependent on claim 9. In support of the rejection of claim 9, the Examiner, in justifying the obviousness of modifying the cone of Stark et al., by replacing the cone's orifice forming a neck and a diverging section comprising a solid continuous wall with a porous diverging section, taught by Frenzl, indicates that this modification to the cone of Stark et al. is "in order to eliminate or reduce a fluid boundary layer on the inner wall of the diverging section in series with a converging section of the double cone in order to increase a double cone's efficiency (Frenzl - col. 2 ll. 56-64)," (Office Action, page 4, lines 12-15).

It appears to be true, as the Examiner states, that Frenzl teaches this porous diverging section to allow the elimination or reduction of a fluid boundary layer on the inner wall of the

diverging section. The porous diverging section 21 accomplishes this by allowing superheated steam to pass through its pores into zone 22 of the diverging cone to form a layer of steam moving along the wall of the nozzle into the remaining portions of diverging cone 20. This film of steam minimizes the tendency of water striking the nozzle walls to form a liquid boundary layer in the diverging portions of the nozzle, (see Frenzl, column 5, lines 29-57).

It appears that the Examiner's rejection of claim 16 does not meet the provisions of claim 16. In order to make this rejection, he includes Frenzl in the combination of references supporting the rejection. However, Frenzl teaches <u>the elimination or reduction</u> of <u>a fluid boundary layer on the inner wall of the diverging section</u>. In contrast, claim 16 requires <u>the flow profiles of the fluid</u> in the second porous diverging section and in the third diverging section <u>to remain in contact with the wall of the second porous diverging section, and with the wall of the third diverging section</u>. Moreover, the Examiner's rejection relies on the teaching of Frenzl of <u>the elimination or reduction of a fluid boundary layer on the inner wall of a diverging section</u> of a nozzle and the teaching of Stark et al. that <u>the fluid remains in contact with the wall of a double-cone device</u>, which appears to <u>contradict</u> the teaching of Frenzl.

The Examiner in the Advisory Action, however, contended that Frenzl teaches that fluid passing through the diverging section comes in contact with the walls of the nozzle, but that the fluid does not remain there so long as to form a fluid boundary layer. The Examiner further contended that Stark et al. teaches reducing wear on the inner walls by reducing the turbulence of fluid flowing through a double-cone device. Finally, the Examiner contended that Frenzl teaches that a gas layer is formed on the wall section of the porous diverging section, while still permitting inlet fluid to strike the wall section without forming a liquid boundary layer and that nothing in Frenzl suggests that having a gas layer boundary increases the wear on the walls of the diverging sections, (Advisory Action, page 2, paragraph 3, lines 6-12).

From the above contentions, it appears that the Examiner is attempting to rebut any possible conclusion that Frenzl contradicts the teaching of Stark et al. of reducing wear on the inner walls since he contends that nothing in Frenzl suggests that having a gas layer boundary increases the wear on the walls of the diverging sections.

However, Applicant is not attempting to suggest that Frenzl somehow negates the teaching of Stark et al. regarding reduction of wear on the walls of the device. Applicant does,

however, contend that Frenzl teaches the reduction or elimination of a fluid boundary layer from the inner wall of the diverging section of a nozzle, with which the Examiner apparently agrees, and that Stark et al. contradicts the teaching of Frenzl in that the fluid remains in contact with the wall of the double-cone device in Stark et al.

The Examiner, in rejecting claim 16, contends that Stark et al. teaches that the wall is subject to fluid contact to meet the provisions of claim 16 that the flow profiles of the fluid in the neck, in the second porous diverging section, and in the third porous diverging section remain in contact with the wall of the neck, with the wall of the second porous diverging section, and with the wall of the third diverging section, (Office Action, page 7, lines 17-22; page 8, lines 2-4). However, in attempting to obtain the feature of claim 9, upon which claim 16 is dependent, of a porous diverging section, the Examiner uses Frenzl to modify the cone of Stark et al. to eliminate or reduce a fluid boundary layer on the inner wall of the diverging section in series with a converging section of the double cone in order to increase a double-cone's efficiency, (Office Action, page 4, lines 9-15).

Thus, by attempting to obtain both of the features of claim 16 of the fluid remaining in contact with the walls of the double-cone device and the feature of a porous diverging section, the Examiner is indicating that the motivation to use the porous diverging section of Frenzl is to eliminate or reduce the fluid boundary layer on the inner wall of the diverging section. However, fluid remaining in contact with the wall of the second porous diverging section of the double-cone device is part of the features of claim 16, now claim 22. Furthermore, the Examiner, in justifying the modification of the cone of Stark et al. with the porous diverging section of Frenzl in order to eliminate or reduce the fluid boundary layer on the inner wall of the diverging section, contradicts the teaching of Stark et al. that the fluid remains in contact with the wall of the double-cone device. Thus, the motivation to combine Frenzl with Stark et al., asserted by the Examiner, is contradicted by Stark et al., and the combination of Frenzl with Stark et al., on the basis asserted by the Examiner, is thus unobvious.

New dependent claim 23 has been added, dependent on independent claim 22, which provides that no drastic changes in the flow profile occur and that the flow profile reduces the wear and tear of the double-cone device. Antecedent basis for dependent claim 23 is found in the specification, for example, on page 11, lines 4-13.

Dependent claim 23 has been added, pursuant to the suggestion of the Examiner in the interview conducted with him on July 21, 2010 that allowable subject matter would be produced by incorporating claim 16 into claim 9 and further providing that no drastic changes in the flow profile occur and that the flow profile reduces the wear and tear of the double-cone device.

In view of the foregoing amendments and remarks, allowance of claims 9-12, 16, and 18-23 is respectfully requested.

Respectfully submitted,

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